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CLAIMS

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(57) [Claim(s)]
[Claim 1]
Classify a processing tub into the washing processing section and the desiccation processing section, and a clearance is formed in the joint of this both processing section. Make a sink open this clearance for free passage and this substrate is moved to this desiccation processing section from this washing processing section at the time of substrate desiccation. The substrate approach characterized by the thing in which this clearance was formed, and which is made for this substrate to inject a dry gas as a perforated plate is inserted caudad and the internal pressure of this washing processing section becomes lower than the internal pressure of the desiccation processing section more highly [the internal pressure of this desiccation processing section] than the internal pressure of a sink.
[Claim 2]
Said washing processing section is the substrate approach according to claim 1 made as [perform / prepare independently a processing liquid feed zone and the processing liquid blowdown section in the pars basilaris ossis occipitalis, respectively, and / at the time of substrate washing / the following (a) – (d) processes].
(a) The process which supplies a drug solution in said processing tub from this processing liquid feed zone, and stores a drug solution in this processing tub,
(b) The process which carries out charge immersion of said substrate, and performs drug solution processing of a predetermined time this substrate in this processing tub,
(c) The process which supplies a penetrant remover from this processing liquid feed zone after termination of drug solution processing, and discharges this drug solution through this processing liquid blowdown section from this processing tub,
(d) The process which suspends supply of this penetrant remover after discharging this drug solution.
[Claim 3]

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PRIOR ART

[Description of the Prior Art]
In the production process of a semi-conductor, in order to make the front face of a semiconductor wafer pure among various substrates, after a drug solution washes a wafer front face, processing liquid, such as pure water, washes and processing which dries a wafer using organic solvents, such as isopropyl alcohol (IPA), further is performed. After this processing washes a wafer with a drug solution and pure water, it exposes a wafer to the vapor of IPA and makes IPA more specifically condense on the surface of a wafer. By condensation of this IPA The pure water which had adhered to the wafer till then is made to permute by IPA, and it consists of a desiccation process which evaporates IPA and dries a wafer front face the process which flushes pollutants, such as particle, and after that in connection with this pure water flowing and falling from the front face of a wafer. In this desiccation process, if it remains even when waterdrop is slight on the surface of a wafer, a water mark will be formed in a wafer front face, and this water mark will become the cause of worsening the quality of a wafer like particle.

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MEANS

[Means for Solving the Problem]
The following means can attain the above-mentioned object. Namely, the substrate approach of this invention classifies a processing tub into the washing processing section and the desiccation processing section. Form a clearance in the joint of this both processing section, and a sink is made to open this clearance for free passage. At the time of substrate desiccation A substrate is moved to this desiccation processing section from this washing processing section, and it is characterized by the thing in which this clearance was formed and which is made for this substrate to inject a dry gas as a perforated plate is inserted caudad and the internal pressure of this washing processing section becomes lower than the internal pressure of the desiccation processing section more highly [the internal pressure of this desiccation processing section] than the internal pressure of a sink.
[0013]
According to this substrate approach, after a dry gas is supplied to the group of two or more substrates in the desiccation processing section at the time of substrate desiccation, as for some dry gases, the remainder is exhausted [to a sink] through the washing processing section outside from the above-mentioned clearance. Under the present circumstances, since the internal pressure of the desiccation processing section becomes high certainly from the internal pressure of the washing processing section, the downflow of the dry gas in the desiccation processing section becomes smooth, and can perform efficiently surface treatment of the group of two or more substrates by the laminar flow of a dry gas.
[0014]
Moreover, it is characterized by making as [perform / said washing processing section prepares independently a processing liquid feed zone and the processing liquid blowdown section in the pars basilaris ossis occipitalis, respectively, and / the substrate approach of this invention / at the time of substrate washing / the following (a) - (d) processes].
(a) The process which supplies a drug solution in said processing tub from this processing liquid feed zone, and stores a drug solution in this processing tub,
(b) The process which carries out charge immersion of said substrate, and performs drug solution processing of a predetermined time this substrate in this processing tub,

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]
However, in a substrate processor given [above-mentioned] in patent reference, since a part of dry gas is emitted outside from an exhaust pipe, flowing back within a processing tub, the flow of the dry gas within a processing tub will not become fixed, but will be in a turbulent flow condition. Consequently, nitrogen gas is not supplied to each wafer at homogeneity, but processing nonuniformity occurs in a substrate side. As the dry gas of this processing nonuniformity increases, a turbulent flow condition becomes severe, processing nonuniformity is also expanded and the stable surface treatment becomes more nearly impossible. Moreover, since the number of the processing liquid blowdown holes of the pars basilaris ossis occipitalis of an inner lift is one, it has also become clear that the turbulent flow in a tub becomes it intense that there are many dry gas flow rates, for example, they serve as 100 L/min extent. Also since, as for one of the sources of release of the turbulent flow, the desiccation processing section and the washing processing section are not classified for the processing tub, it thinks.
[0008]
On the other hand, when the exhaust air processing facility to which an exhaust pipe is connected was investigated, it turned out that the cause of the above-mentioned turbulent flow is also in this exhaust air processing facility. Usually, the exhaust pipe from a substrate processor is connected to the exhaust air processing facility in works. A vacuum pump is used, two or more device and equipments are connected to this pump, this exhaust air processing facility is put in block, and management of exhaust air processing is made. Therefore, if the fine adjustment for every those devices and equipments is difficult and tends to carry out individual adjustment in consideration of the specification of each device and equipment, the jump of an installation cost will not be avoided. And in the usual exhaust air processing facility, fluctuation of exhausting agency ** is intense at the time of the early stages of starting, or a halt.

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EFFECT OF THE INVENTION

[Effect of the Invention]
Since a dry gas can be supplied to the substrate aggregate at homogeneity according to the substrate approach of this invention as explained in full detail above, a water mark is not formed on the surface of a substrate, and, moreover, clearance of particle, adhesion, or the reattachment can also be prevented.
[0048]
Since according to the substrate processor of this invention a processed substrate does not touch atmospheric air with a series of down stream processing at all since it is carried out within one sealed processing tub, and a dry gas can moreover be supplied to the substrate aggregate at homogeneity, a water mark is not formed on the surface of a substrate, and, moreover, clearance of particle, adhesion, or the reattachment can also be prevented.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs]
This invention relates to the substrate approach for processing a semiconductor wafer, the substrate for liquid crystal displays, the substrate for record disks or the substrate for masks, and other substrates, and its equipment, and relates to the substrate approach and substrate processor which enabled it to perform a series of surface treatment from processing by the drug solution of said various substrates to desiccation etc. by one processing tub in detail.
[0002]
[Description of the Prior Art]
In the production process of a semi-conductor, in order to make the front face of a semiconductor wafer pure among various substrates, after a drug solution washes a wafer front face, processing liquid, such as pure water, washes and processing which dries a wafer using organic solvents, such as isopropyl alcohol (IPA), further is performed. After this processing washes a wafer with a drug solution and pure water, it exposes a wafer to the vapor of IPA and makes IPA more specifically condense on the surface of a wafer. By condensation of this IPA The pure water which had adhered to the wafer till then is made to permute by IPA, and it consists of a desiccation process which evaporates IPA and dries a wafer front face the process which flushes pollutants, such as particle, and after that in connection with this pure water flowing and falling from the front face of a wafer. In this desiccation process, if it remains even when waterdrop is slight on the surface of a wafer, a water mark will be formed in a wafer front face, and this water mark will become the cause of worsening the quality of a wafer like particle. For this reason, it must be made for these pollutants etc. not to have to adhere to a wafer in the production process of a semi-conductor. And many the substrate surface treatment method and processors which took such a cure, such as a wafer, are devised and put in practical use, and many patent reference is also introduced. (For example, patent reference 1 reference)
[0003]
[Patent reference 1]
JP,2001-271188,A (drawing 1 , the 5th page right column - 6th page left column)
[0004]
The substrate processor indicated by said patent reference is equipped with one processing tub. This processing tub Several wafers are formed in the magnitude of extent which sets necessary spacing and can carry out support hold in juxtaposition in the vertical condition. the closed-end box in which the upper part carried out opening, and its opening -- from a wrap lid -- becoming -- opening of a box -- many -- When the depth of a box is immersed in the shape of devotion in a wafer, it is formed in the depth which is extent from which the up space of the proper volume which supplies inert gas to the upper part side is secured. After drug solution processing, the rinsing processing which washes out a drug solution from the front face of a wafer with the pure water for washing, and this rinsing processing are completed using this processing tub, processing which results in the desiccation processing which removes the attached groundwater which is carrying out the adhesion residual on the surface of the wafer by the mixed permutation

of the steam of an organic solvent and inert gas is performed.
[0005]
Then, when the flow of the inert gas within the processing tub in the desiccation process of said wafer was investigated, the root as shown in drawing 9 was observed. In addition, drawing 9 is the sectional view having shown the flow of the inert gas within a processing tub typically. This substrate processor 1 is equipped with the processing tub 2 which a top face becomes from the inner lift 21 of the closed-end cube type which carried out opening, the outside tub 22 which surrounds the up periphery of this inner lift 21, and the lid 23 which can be opened and closed, and which was prepared in the upper part of an outside [this] tub. The processing liquid blowdown hole 212 is formed in the pars basilaris ossis occipitalis of an inner lift 21, an exhaust pipe 5 is connected to this blowdown hole, and that other end is connected with the vacuum pump etc. Moreover, as for projections and these deliveries 8, the vapor delivery 8 is connected with vapor ****** 9 in the outside tub 22. Furthermore, as for a mounting eclipse and its injection nozzle 41, the gas injection nozzle 41 is connected to the source 7 of nitrogen gas supply by piping 4 in the upper part of a lid 23.
[0006]
In this substrate processor 1, if the nitrogen gas N2 (dry gas) from the source 7 of nitrogen gas supply is injected from the upper part of the processing tub 2, the injected nitrogen gas N2 will flow toward a lower part, will be injected to wafer accumulation object W', and will be emitted out of a tub from an exhaust pipe 5 after that. A part of injection gas is emitted out of a sink 3 from the clearance a between the outside tub 22 and a lid 23 in that case. The outside of a sink 3 has atmospheric pressure. Moreover, as the arrow head of drawing 9 shows, to the bottom wall side of an inner lift 21 etc., it collides, and the gas injected to wafer accumulation object W' goes up, flows back the inside of the processing tub 2, and after [this] flowing back, it is emitted outside from an exhaust pipe 5. And surface desiccation is performed by the gas which flowed back the inside of the gas by which direct injection of wafer accumulation object W' was carried out from the injection nozzle 41, and the processing tub 2.
[0007]
[Problem(s) to be Solved by the Invention]
However, in a substrate processor given [above-mentioned] in patent reference, since a part of dry gas is emitted outside from an exhaust pipe, flowing back within a processing tub, the flow of the dry gas within a processing tub will not become fixed, but will be in a turbulent flow condition. Consequently, nitrogen gas is not supplied to each wafer at homogeneity, but processing nonuniformity occurs in a substrate side. As the dry gas of this processing nonuniformity increases, a turbulent flow condition becomes severe, processing nonuniformity is also expanded and the stable surface treatment becomes more nearly impossible. Moreover, since the number of the processing liquid blowdown holes of the pars basilaris ossis occipitalis of an inner lift is one, it has also become clear that the turbulent flow in a tub becomes it intense that there are many dry gas flow rates, for example, they serve as 100 L/min extent. Also since, as for one of the sources of release of the turbulent flow, the desiccation processing section and the washing processing section are not classified for the processing tub, it thinks.
[0008]
On the other hand, when the exhaust air processing facility to which an exhaust pipe is connected was investigated, it turned out that the cause of the above-mentioned turbulent flow is also in this exhaust air processing facility. Usually, the exhaust pipe from a substrate processor is connected to the exhaust air processing facility in works. A vacuum pump is used, two or more device and equipments are connected to this pump, this exhaust air processing facility is put in block, and management of exhaust air processing is made. Therefore, if the fine adjustment for every those devices and equipments is difficult and tends to carry out individual adjustment in consideration of the specification of each device and equipment, the jump of an installation cost will not be avoided. And in the usual exhaust air processing facility, fluctuation of exhausting agency ** is intense at the time of the early stages of starting, or a halt. For this reason, although effect of exhausting agency ** in this exhaust air processing facility must be made into the minimum in order to process the wafer of a large quantity, maintaining high quality,

in the above-mentioned substrate processor, that adjustment is very difficult.
[0009]
In recent years, in order that substrates, such as a wafer processed within a processing tub, may raise processing efficiency, it is necessary to insert many substrates into a tub in the condition of having held to the elevator style, as much as possible, and a substrate is simultaneously processed within a processing tub by the lot unit of 50-100 sheets depending on the case. In this case, since each substrate of each other is supported by parallel with the position stood vertically, the pitch between substrates becomes several mm and a narrow thing. Thus, carry out drug solution processing of a lot of substrates within a processing tub, or when performing rinse processing by pure water, supply processing liquid to the interior of a processing tub, inserting a lot of substrates into a processing tub, or although it is necessary to make it permute by other processing liquid etc., the processing speed to each substrate varies in that case, or the technical problem of the time amount which desiccation takes being long and being easy to generate particle etc. from this thing occurs.
[0010]
This invention takes the above situations into consideration, the technical problem in the desiccation process especially in the conventional example is solved, and the 1st object of this invention is to offer the substrate approach the dry gas enabled it to supply to two or more substrates aggregate at homogeneity and stability.
[0011]
In case the 2nd object of this invention processes the substrate of a large quantity, it lessens the contamination goods which adhere on the surface of a substrate, and is to offer the substrate processor which prevented lowering of the yield by contamination.
[0012]
[Means for Solving the Problem]
The following means can attain the above-mentioned object. Namely, the substrate approach of this invention classifies a processing tub into the washing processing section and the desiccation processing section. Form a clearance in the joint of this both processing section, and a sink is made to open this clearance for free passage. At the time of substrate desiccation A substrate is moved to this desiccation processing section from this washing processing section, and it is characterized by the thing in which this clearance was formed and which is made for this substrate to inject a dry gas as a perforated plate is inserted caudad and the internal pressure of this washing processing section becomes lower than the internal pressure of the desiccation processing section more highly [the internal pressure of this desiccation processing section] than the internal pressure of a sink.
[0013]
According to this substrate approach, after a dry gas is supplied to the group of two or more substrates in the desiccation processing section at the time of substrate desiccation, as for some dry gases, the remainder is exhausted [to a sink] through the washing processing section outside from the above-mentioned clearance. Under the present circumstances, since the internal pressure of the desiccation processing section becomes high certainly from the internal pressure of the washing processing section, the downflow of the dry gas in the desiccation processing section becomes smooth, and can perform efficiently surface treatment of the group of two or more substrates by the laminar flow of a dry gas.
[0014]
Moreover, it is characterized by making as [perform / said washing processing section prepares independently a processing liquid feed zone and the processing liquid blowdown section in the pars basilaris ossis occipitalis, respectively, and / the substrate approach of this invention / at the time of substrate washing / the following (a) - (d) processes].
(a) The process which supplies a drug solution in said processing tub from this processing liquid feed zone, and stores a drug solution in this processing tub,
(b) The process which carries out charge immersion of said substrate, and performs drug solution processing of a predetermined time this substrate in this processing tub,
(c) The process which supplies a penetrant remover from this processing liquid feed zone after

termination of drug solution processing, and discharges this drug solution through this processing liquid blowdown section from this processing tub,
(d) The process which suspends supply of this penetrant remover after discharging this drug solution.
[0015]
Since a series of processings of a drug solution, washing, and desiccation can be performed using a common processing tub according to this substrate approach, a substrate is not exposed to air during this the processing of a series of. Therefore, while the effectiveness of substrate processing increases, contamination according formation of the natural oxidation film to control, particle, etc. can be prevented.
[0016]
As for operating this drain device at the same time it prepares a drain device in this processing liquid blowdown section and inserts a perforated plate between said washing processing section and said desiccation processing section at the time of substrate desiccation, and making the processing liquid of said washing processing circles discharge for a short time, and said perforated plate, in said processing liquid blowdown section, it is desirable that it is the punching plate which prepared two or more stomata of the diameter of predetermined.
According to this substrate approach, each stoma of a punching plate can make internal pressure of the desiccation processing section high certainly from the internal pressure of the washing processing section according to the orifice effectiveness while distributing a dry gas. Moreover, the downflow of the dry gas in the desiccation processing section becomes smooth by actuation of this drain device by making a large quantity discharge the processing liquid of said washing processing circles quickly, and the laminar flow of a dry gas can perform efficiently surface treatment of two or more substrates group.
[0017]
The support means which supports two or more substrates which should process the substrate processor of this invention with parallel and a vertical position with pitches [each other], It has the washing processing tub which holds the aggregate of the substrate supported by this support means, and the lid which functions considering up opening of this washing processing tub as a bonnet desiccation processing tub. This lid It consists of a container in which it has the magnitude which can hold the aggregate of this substrate, the head-lining side was closed, and the lower part carried out opening. Two or more injection nozzles align at equal intervals mostly in the shape of a field in the head-lining side of this container, and each injection nozzle hole is established in it towards this substrate aggregate. The clearance where this lid opened up opening of this washing processing tub for free passage in the sink between this washing processing tub and this lid on the wrap occasion is formed, and it is characterized by inserting a perforated plate down this clearance.
[0018]
According to this substrate processor, after a dry gas is supplied to the group of two or more substrates in a desiccation processing tub at the time of substrate desiccation, as for some dry gases, the remainder is exhausted [to a sink] through a washing processing tub outside from the above-mentioned clearance. Under the present circumstances, since the internal pressure of a desiccation processing tub becomes high certainly from the internal pressure of the washing processing section, the downflow of the dry gas in a desiccation processing tub becomes smooth, and can perform efficiently surface treatment of two or more substrates group by the laminar flow of a dry gas.
[0019]
Moreover, the processing liquid feed zone and the processing liquid blowdown section by which said washing processing tub was independently prepared in the pars basilaris ossis occipitalis, respectively, Processing liquid supply system piping which is connected to this processing liquid feed zone, and supplies processing liquid to this processing tub, The drug solution supply source which supplies a drug solution to this processing liquid supply system piping, and a penetrant remover supply means to wash this substrate by supplying a penetrant remover to this processing tub through this processing liquid supply system piping, and flooding the penetrant

remover of a parenthesis from the upper part of this processing tub, It is desirable to provide blowdown piping which leads the penetrant remover which is connected to this processing liquid blowdown section, and is discharged from this processing tub to the exterior of this processing tub.
Since a series of processings of a drug solution, washing, and desiccation can be performed using a common processing tub according to this configuration, a substrate is not exposed to air during this the processing of a series of. Therefore, while the effectiveness of substrate processing increases, contamination according formation of the natural oxidation film to control, particle, etc. can be prevented.
[0020]
This drain device is operated at the same time it prepares a drain device in said processing liquid blowdown section and said perforated plate is inserted between said washing processing tubs and said lids at the time of desiccation of said substrate aggregate, Moreover, it is desirable that they are that said two or more injection nozzles are prepared in the head-lining side of said container along the periphery edge of said substrate aggregate so that the distance of this periphery edge and each nozzle hole may become almost equal, and the punching plate in which said perforated plate has two or more holes of the diameter of predetermined further.
According to this substrate processor, it is stabilized to said substrate aggregate in homogeneity, and a dry gas can be supplied now to it.
[0021]
[Embodiment of the Invention]
Hereafter, the gestalt of suitable implementation of this invention is explained, referring to a drawing. In addition, this invention is not limited to what was indicated by the drawing. The sectional view in which drawing 1 shows the substrate processor of 1 operation gestalt of this invention, and drawing 2 are a side elevation from one side of a processing tub, and the side elevation of the lid with which the side elevation from another side and drawing 4 are shown in the top view (this drawing is a top view seen through from the lid upper part) of a lid, and drawing 3 shows drawing 5 to drawing 4 .
[0022]
It is a facility for the substrate processor 10 to process semiconductor wafer W as an example of a substrate with reference to drawing 1 . The processings said here are the process which carries out hydrofluoric acid treatment of the front face of Wafer W which etches for example, the wafer W with a drug solution or the rinse processing which washes Wafer W in cold water, desiccation processing which dries the wafer W after washing in cold water by the organic solvent. Processing of these single strings is continuously performed within one processing tub 15.
[0023]
The processing tub 15 is installed in the hold room 11 which has the volume which makes together with the attachment and can be held, as shown in drawing 2 -5. Attachment is the air conditioner which performs air conditioning of the hold interior of a room, the supply source which supplies various kinds of processing liquid to a processing tub, a wafer conveyance device, etc., and these are omitted by a diagram. It has the wrap lid 30 for opening of the inner lift 20 of the closed-end cube type with which the top face carried out opening of the processing tub 15, the outside tub 25 which surrounds the up periphery of this inner lift 20, and this inner lift 20, and the inside-and-outside tubs 20 and 25 are held in a sink 29. The inside-and-outside tubs 20 and 25 are formed with the ingredient which is hard to be corroded with organic solvents, such as fluoric acid and IPA, for example, polyvinylidene fluoride etc.
[0024]
An inner lift 20 holds the oban wafer W of 300mm of a large quantity, for example, a diameter, and about 50 sheets with a holder 62, it has the depth which is immersed in processing liquid and can be processed, and the processing liquid blowdown section 21 and the processing liquid feed zone 22 are formed in the pars basilaris ossis occipitalis. The substrate holder 62 is held for example, using a cassette guide in the condition of having stood up at [two or more wafers W are pitches / parallel / mutually, and] right angles to this cassette guide 62. This substrate

holder (cassette guide) 62 is connected with the elevator style 60, the rise-and-fall means 61 is formed in this elevator style, the cassette guide 62 is moved to a vertical perpendicular direction by this rise-and-fall means 61, and the receipts and payments to an inner lift 20 are performed. "Dry Position" of drawing 2 expresses the location of a desiccation process, and "Rinse Position" expresses the location of a washing process. For example, an air-cylinder device is used for the rise-and-fall means 61.

[0025]

Ejection of the wafer aggregate from the cassette guide 62 is performed by the migration device 50. This migration device 50 is equipped with two or more grasping pawls 501 and 502 connected with the robot device (graphic display abbreviation), and by these grasping pawls 501 and 502, the wafer aggregate is grasped and it is moved to a predetermined location. Moreover, as the processing liquid blowdown section 21 is shown in drawing 2 , it consists of an exhaust port 211 of a minor diameter, and an exhaust port 212 of a major diameter, and the exhaust port 212 of a major diameter functions as a drain device which discharges the processing liquid in a processing tub quickly. The exhaust port 211 of a minor diameter makes the processing liquid stored in the pars basilaris ossis occipitalis of an inner lift 20, and tubing discharge. The outside tub 25 functions as an overflow tub for receiving the processing liquid which overflows from the upper part of an inner lift 20. An exhaust port 251 is formed in the low location of the outside [this] tub 25.

[0026]

as shown in drawing 5 , the lower part carries out opening of the lid 30, and the upper part closes it — having -- the interior -- many -- it consists of a box-like container 31 which has the magnitude which can contain wafer aggregate W' which collected several wafers W, and this container 31 is formed with the ingredient which is hard to be corroded with organic solvents, such as fluoric acid and IPA. This lid 30 can be horizontally moved now from the migration means 55 (refer to drawing 3). This migration means 55 plugs up or opens opening of an inner lift 20 by making the upper part of an inner lift 20 move a lid 30 horizontally, as the arrow head of drawing 2 shows. That is, it moves to predetermined distance **** raising and a horizontal direction, the lid 30 located on an inner lift 20 is perpendicularly taken down down the perpendicular direction after it, and it is held at a standby condition. Migration of this lid 30 is performed in case the wafer aggregate [finishing / carrying in of wafer aggregate W' into an inner lift 20 and processing] is taken out from an inner lift 20.

[0027]

Moreover, as shown in drawing 5 , the arch-like head-lining side 32 is mostly formed in that upper part, two or more injection nozzles 331-337 which inject inert gas align on all sides at equal intervals mostly, and the box-like container 31 is arranged in this head-lining side 32. Two or more nozzles 33 are above wafer aggregate W', as shown in drawing 4 , two or more injection nozzles 331-337 mostly arranged at equal intervals by the line writing direction are arranged also in the direction of a train, and two or more trains are arranged mostly at equal intervals. In drawing 4 , six trains and a total of 42 injection nozzles 331-3386 are arranged in the up periphery edge of wafer accumulation object W' for what was arranged to seven line writing directions. As seven injection nozzles 331-337 in a line writing direction show the relation with wafer aggregate W' to drawing 5 , the distance of each injection nozzles 331-337 and the periphery edge of wafer aggregate W' is arranged in the head-lining side 32 so that it may become almost equal. Since Wafer W is making disc-like in general by forming the head-lining side 32 in the shape of an arch, it becomes easy to make the above-mentioned distance equal. As for the configuration of this head-lining side, it is desirable for it to be changed according to the configuration of Wafer W, and to make the above-mentioned distance almost equal.

[0028]

This supply pipe 342 branches by connecting a gas supply line 342, and the number of an injection nozzle 33 of each injection nozzle 33 is the same as that of these branch pipes 3421 and 3422 respectively, or the number which becomes almost equal is combined. Thereby, gas can be distributed to each injection nozzle almost uniformly. When what injection gas diffuses at a predetermined include angle, respectively is used and gas is injected from each injection nozzle

to the periphery edge of the wafer aggregate, as for each of these injection nozzles 33, it is desirable to set up so that the adjoining injection nozzle 332, for example, an injection nozzle, an injection nozzle 333, and the injection gas of a between may lap on the periphery edge b of the wafer aggregate. By aligning as mentioned above in the head-lining side 32, and arranging two or more injection nozzles 33, gas can be mostly supplied to the wafer aggregate W at homogeneity.
[0029]
Between the inside-and-outside tubs 20 and 25 and a lid 30, as shown in drawing 2 , and 3 and 5, the medium connection member 26 and the perforated plate insertion mechanism 27 are arranged. The medium connection member 26 is formed with a tube-like object with opening of the same magnitude as lower opening of a lid 30. This tube-like object is formed with the ingredient which is hard to be corroded with organic solvents, such as fluoric acid and IPA. This medium connection member 26 is formed above the perforated plate insertion mechanism 27, the downward opening 262 is positioned so that it may be mostly contacted by the top face of the frame 271 which contained the perforated plate, and fitting of the upper opening 261 is carried out to the lower opening 311 of the box-like container 31. In addition, as fitting of the lid 30 is carried out to the direct frame 271, a medium connection member may be excluded.
[0030]
A perforated plate 28 consists of a plate-like plate inserted between the inside-and-outside tubs 20 and 25 and the medium connection member 26 in the process which dries wafer accumulation object W' which predetermined processing ended, and two or more stomata are drilled by the tabular plane. This perforated plate is formed with the ingredient which is hard to be corroded with organic solvents, such as fluoric acid and IPA. This perforated plate 28 is contained in a frame 271, and is connected with a migration device (graphic display abbreviation), and as shown in drawing 2 , slide migration is horizontally carried out. The frame 271 which contains a perforated plate 28 has the predetermined dip (perpendicular direction), and when a perforated plate 28 is contained by the frame 271, a clearance 272 is formed between a frame 271 and a perforated plate 28.
[0031]
This clearance 272 is an about 2mm clearance, and a part of dry gas is emitted into a sink 29 in a desiccation process. Therefore, since Clearance x (this clearance is expressed with x at drawing 8) is formed between an inner lift 20 and a lid 30, during half-sealing, i.e., the desiccation processing section and the washing processing section, will be in a half-sealing condition, without between an inner lift 20 and lids 30 being sealed by this clearance x. Moreover, a perforated plate 28 is inserted between the inside-and-outside tubs 20 and 25 and the medium connection member 26, and functions considering an inner lift and a lid as a shutter with which a partition, i.e., the washing processing section, and the desiccation processing section are divided.

[0032]
Next, with reference to drawing 1 , the piping connection with said processing tub and attachment is explained. The processing liquid installation tubing 221 is connected to the processing liquid feed zone 22 prepared in the pars basilaris ossis occipitalis of an inner lift 20, and this introductory tubing 221 is connected to the pure-water supply source 38 through the flow control valve and the pump. As for this processing liquid installation tubing 221, a penetrant remover supply means consists of nothing, this piping, a flow control valve, and a pump in the function of processing liquid supply system piping. Moreover, it connects with this processing liquid installation tubing 221 through the flow control valve at the drug solution supply source 39 similarly. The drug solution supply source 39 is equipped with the drug solution mixing means (graphic display abbreviation) for preparing a desired drug solution to predetermined concentration and predetermined temperature. A drug solution is chosen from fluoric acid, a hydrochloric acid, hydrogen peroxide solution, a sulfuric acid, ozone water, aqueous ammonia, a surfactant, an amine system organic solvent, a fluorine system organic solvent, electrolysis ion water, etc., corresponding to the object (for example, processing of washing, etching, oxidation, etc.) of processing, and what mixed the drug solution of these plurality if needed is used.
[0033]

Moreover, as the processing liquid blowdown section 21 prepared in the pars basilaris ossis occipitalis of an inner lift 20 is shown in drawing 2 , it consists of an exhaust port 211 of a minor diameter, and an exhaust port 212 of a major diameter, and connects with each at the inner lift drainage tube 231 and 232, and these drainage tube 231 is connected to the effluent processing facility 40 through the closing motion valve, the pump, and the flow control valve. Furthermore, the drainage tube 232 is similarly connected to the exhaust air processing facility 41 through a closing motion valve, a pump, and a flow control valve. Moreover, the sink 29 is also connected to the exhaust air processing facility 411. A drain pipe 251 is connected to the low location of the outside tub 25, and this drain pipe 251 is connected to the drainage tube 231.
[0034]
Vapor ****** 37 is formed near the processing tub 15. It was easy to mix this vapor ****** 37 with the attached groundwater which is carrying out the adhesion residual on the front face of Wafer W, surface tension is very small, for example, it is equipped with the vapor generating tub 371 which is made to heat this organic solvent and is made to evaporate while it stores the organic solvent which consists of an isopropyl alcohol (IPA) solvent etc. It is immersed in the warm water in the heating tub 372, and this vapor generating tub 371 makes an organic solvent heat, and is made to evaporate. This vapor generating tub 371 and the organic solvent (IPA) supply source 36 are connected for piping 361, and IPA is supplied to the vapor generating tub 371.
[0035]
Moreover, the vapor generating tub 371 and the 2nd nitrogen gas N2 source of release 35 are connected with branch pipes 3511 and 3512. From one branch pipe 3512, nitrogen gas N2 is sent to the pars basilaris ossis occipitalis of the vapor generating tub 371, air bubbles are generated in IPA currently stored in the vapor generating tub 371, and evaporation of IPA is promoted. Moreover, the nitrogen gas N2 supplied from the branch pipe 3511 of another side is used as carrier gas. Moreover, this vapor generating tub 371 is connected with piping 342 through piping 3712, and the mixed gas of carrier gas N2 and an IPA steam is supplied to an injection nozzle 33 from the vapor generating tub 371. As for the 1st nitrogen gas N2 source of release 34, nitrogen gas N2 is supplied to an injection nozzle 33 through piping 341 and 342. This nitrogen gas N2 not only purges the inside of the processing tub 15, but is used for finishing desiccation.
[0036]
Next, a series of processings using this substrate processor are explained with reference to drawing 6 and drawing 7 . In addition, drawing 6 R> 6 shows the timing diagram of a series of processings, drawing 7 shows washing / desiccation process, and, as for this drawing (a), the desiccation process 1 and this drawing (c) of a washing process and this drawing (b) are sectional views where the desiccation process 2 and this drawing (d) explain the desiccation process 3.
[0037]
With reference to drawing 1 and 6, aperture and wafer aggregate W' is first held for the lid 30 of the processing tub 15 in an inner lift 20. In the inner lift 20, through the processing liquid installation tubing 221 and the processing liquid feed zone 22, a desired drug solution (HF), for example, fluoric acid, is supplied to an inner lift 20, and it is stored from the drug solution supply source 39 at this time. Therefore, as for wafer aggregate W', processings (for example, etching, hydrofluoric acid treatment, washing, etc.) according to a drug solution are performed by being immersed in this processing liquid.
[0038]
As shown in drawing 7 (a) after completing this drug solution processing, pure water DIW is supplied to an inner lift 20 through the processing liquid installation tubing 221 and the processing liquid feed zone 22 from the pure-water supply source 38. This pure-water supply is performed making it overflow from the upper part of an inner lift 20. The pure water DIW with which it overflowed from the inner lift 20 flows into the outside tub 25, and is discharged through a drain pipe from a drain pipe 251. It carries out applying [of this pure water] it comparatively long time, and said drug solution HF which remained in the inner lift 20 is extruded.
[0039]

After this washing process is completed, at the desiccation process 1 shown in drawing 7 (b), wafer aggregate W' is pulled up from an inner lift 20 slowly (Slow up Speed), suspending continuation supply of pure water DIW and supplying little pure water (water saving of DIW). Although IPA is supplied into the processing tub 15, little IPA can also be supplied to a pull-up and coincidence of this wafer aggregate W'.

[0040]

Subsequently, at the desiccation process 2 shown in drawing 7 (c), the drain device valve of the exhaust port 212 of processing tub 15 pars basilaris ossis occipitalis is operated, processing liquid is discharged quickly, into a frame 271, horizontal migration of the perforated plate 28 is carried out, and it is inserted between the inside-and-outside tubs 20 and 25 and the medium connection member 26. Furthermore, the mixed gas of the nitrogen gas N2 and IPA gas which were able to be warmed in the inner lift 20 is supplied. These actuation is simultaneously performed, as shown in a chart. This nitrogen gas N2 is heated within the vapor generating tub 371. In this process, the vapor of the organic solvent in the processing tub 15 touches the front face of each wafer W, the vapor of an organic solvent condenses on the front face of Wafer W, and the film of an organic solvent is formed in it. If the film of an organic solvent is formed in the front face of Wafer W, since the pure water which had adhered to Wafer W till then will be permuted by the organic solvent, it flows and falls from the front face of Wafer W. At the desiccation process 3 of drawing 7 (d), if nitrogen gas N2 is supplied and the desiccation process 3 is completed in order to dry permuted IPA, wafer aggregate W' will be taken out from the processing tub 15.

[0041]

When the flow of the dry gas in the desiccation process 2 was investigated among the aforementioned desiccation processes 1-3, the root as shown in drawing 8 was observed. Drawing 8 is the sectional view having shown typically the flow of the dry gas in drawing 7 (c). A dry gas (IPA+HotN2) is injected from the injection nozzle 33 of the upper part of a lid 30 to wafer aggregate W'. At this time, Clearance x is formed between the inner lift 20 and the lid 30, and between half-sealing conditions, i.e., the desiccation processing section and the washing processing section, is in the half-sealing condition, without between an inner lift 20 and lids 30 being thoroughly sealed by this clearance x. For this reason, a part of that dry gas injected to wafer aggregate W' flows into a sink 29 from the clearance x between an inner lift 20 and a lid 30.

[0042]

Moreover, since the processing tub 15 is installed in the air-conditioned hold room 11, air 12a is sprayed under the arrow head from the upper air conditioning machine 12 of this hold room 11. Consequently, a part is exhausted for the dry gas emitted through piping 222 from this clearance x, and the remaining gas flows into a sink 29 together with air 12a, and is exhausted by the exhauster connected with the sink 29. Since the dry gas injected from the injection nozzle 33 is emitted through Clearance x, only the part of capacity which flows into an inner lift 20 decreases. The amount emitted through this clearance x is comparatively abundant. For this reason, a dry gas can be exhausted, without being influenced of fluctuation of the exhaust air origin in an exhaust air processing facility.

[0043]

That is, since a part is emitted into a sink 29 from Clearance x after a dry gas is injected to wafer aggregate W', the capacity which flows into an inner lift 20 has decreased that much. For this reason, a dry gas can be made to exhaust smoothly, without that being influenced not much, even if there is fluctuation of an exhausting agency. Since the effect is made small and the clean air of a large quantity is moreover supplied from the upper part of the hold room 11 rather than it catches in the narrow space of an inner lift and an outside tub, since it will come to catch in the large space which added fluctuation of an exhausting agency to the inner lift and the outside tub, and includes a sink by forming Clearance x, if it furthermore explains in full detail, effect of the fluctuation is made further small.

[0044]

It is exhausted, while the dry gas which passes through this since the stoma of plurality

[perforated plate / 28 / plate] on the other hand exists is distributed by two or more stomata, and a big pressure differential occurs according to the cage festival effectiveness between a lid 30 and an inner lift 20 (i.e., between the lid which constitutes drying room, and the inner lifts which constitute the washing room) and the dry gas in drying room carries out a downflow smoothly. For this reason, the pressure of a lid 30 (desiccation processing section) becomes high certainly from the pressure of an inner lift 20 (washing processing section).

[0045]

If each pressure relation within the processing tub 15 and a sink 29 is shown for this situation,

P1>P2>P3> exhaust air former **

P1>P4> exhaust air former **

****** is materialized.

For P1, as for an inner lift 20 and a pressure P3, the pressure of a lid 30 (desiccation processing section) and P2 are [the pressure within an exhaust pipe and P4] the pressures in a sink 29 here.

[0046]

Therefore, by filling the relation of the above [each pressure within the processing tub 15 and a sink 29], this dry gas forms a laminar flow in the processing tub 15, and it is smoothly exhausted out of a tub from an exhaust pipe, and in this process, each wafer is supplied at homogeneity, and a water mark is not formed on the surface of a substrate, and a dry gas can also prevent clearance and adhesion of particle. And the reattachment of particle can also be prevented. The reason is that a dry gas does not flow back within a processing tub.

[0047]

[Effect of the Invention]

Since a dry gas can be supplied to the substrate aggregate at homogeneity according to the substrate approach of this invention as explained in full detail above, a water mark is not formed on the surface of a substrate, and, moreover, clearance of particle, adhesion, or the reattachment can also be prevented.

[0048]

Since according to the substrate processor of this invention a processed substrate does not touch atmospheric air with a series of down stream processing at all since it is carried out within one sealed processing tub, and a dry gas can moreover be supplied to the substrate aggregate at homogeneity, a water mark is not formed on the surface of a substrate, and, moreover, clearance of particle, adhesion, or the reattachment can also be prevented.

[Brief Description of the Drawings]

[Drawing 1] The sectional view showing the substrate processor of 1 operation gestalt of this invention,

[Drawing 2] The side elevation showing a processing tub,

[Drawing 3]

The side elevation which saw the processing tub of drawing 2 from another side,

[Drawing 4]

The top view of a lid (this drawing is a top view seen through from the lid upper part),

[Drawing 5]

The side elevation of the lid shown in drawing 4 ,

[Drawing 6]

The table showing the timing diagram of a series of processings,

[Drawing 7]

Washing / desiccation process is shown, for drawing 7 (a), it is a washing process and drawing 7 (b) is the desiccation process 1 and drawing.

It is the sectional view where 7 (c) explains the desiccation process 2 and drawing 7 (d) explains the desiccation process 3,

[Drawing 8]

The sectional view having shown typically the flow of the dry gas in drawing 7 (c),

[Drawing 9]

The cross section which showed the flow of the inert gas within the processing tub in the

substrate processor of the conventional technique
It is drawing.
[Description of Notations]
1 Ten Substrate processor
11 Hold Room
12 Air Conditioning Machine
15 Processing Tub
20 Inner Lift
21 Processing Liquid Blowdown Section
212 Drain Device
221 Processing Liquid Installation Tubing (Processing Liquid Supply System Piping)
22 Processing Liquid Feed Zone
25 Outside Tub
26 Medium Connection Member
27 Perforated Plate Insertion Mechanism
28 Perforated Plate
29 Sink
30 Lid
31 Box-like Container
33 Injection Nozzle
37 Vapor ******
371 Vapor Generating Tub
55 Migration Means

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The sectional view showing the substrate processor of 1 operation gestalt of this invention,
[Drawing 2] The side elevation showing a processing tub,
[Drawing 3]
The side elevation which saw the processing tub of drawing 2 from another side,
[Drawing 4]
The top view of a lid (this drawing is a top view seen through from the lid upper part),
[Drawing 5]
The side elevation of the lid shown in drawing 4 ,
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The table showing the timing diagram of a series of processings,
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Washing / desiccation process is shown, for drawing 7 (a), it is a washing process and drawing 7 (b) is the desiccation process 1 and drawing.
It is the sectional view where 7 (c) explains the desiccation process 2 and drawing 7 (d) explains the desiccation process 3,
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[Drawing 9]
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37 Vapor ******
371 Vapor Generating Tub
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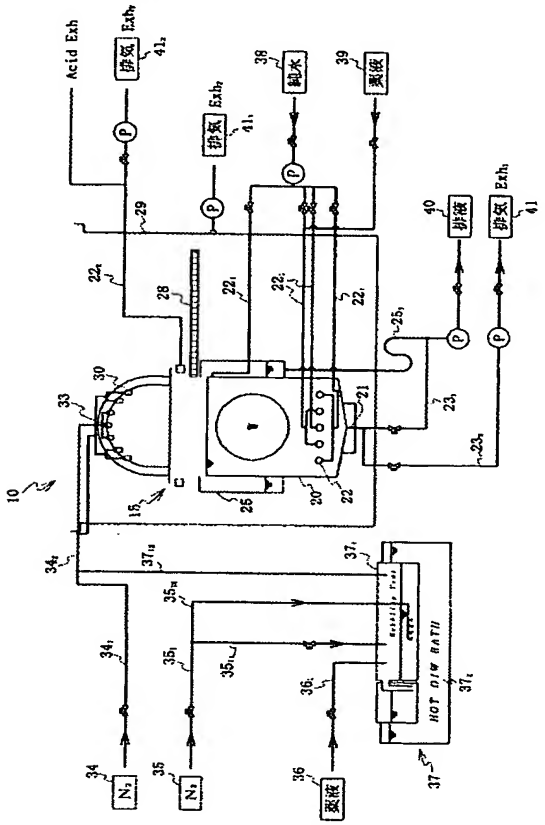
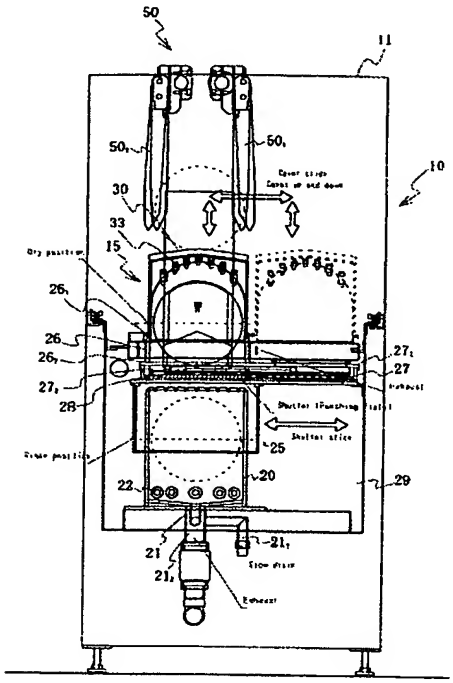
DRAWINGS

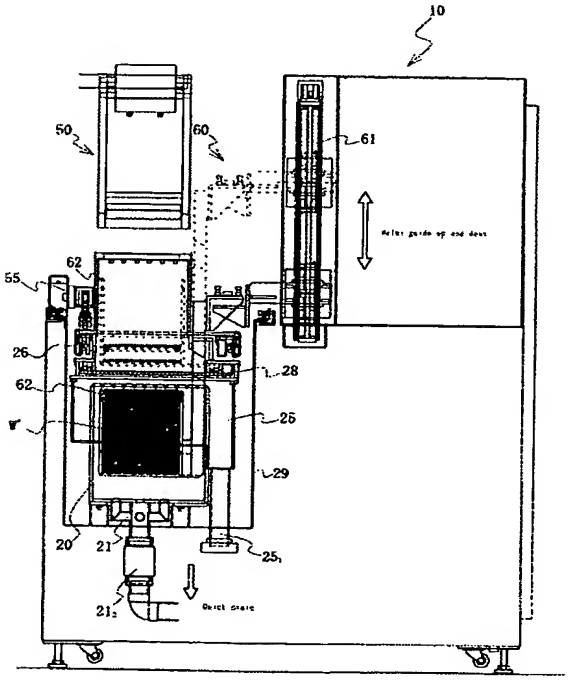
[Drawing 1]



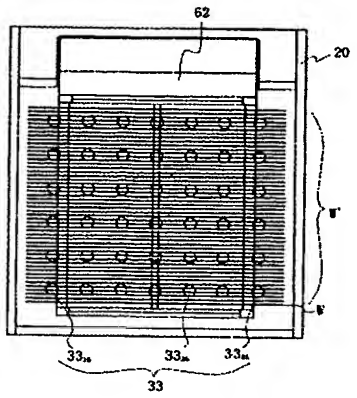
[Drawing 2]



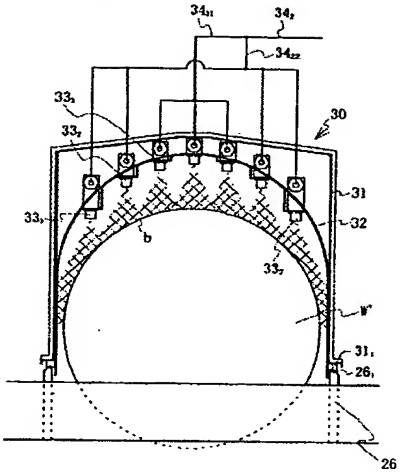
[Drawing 3]



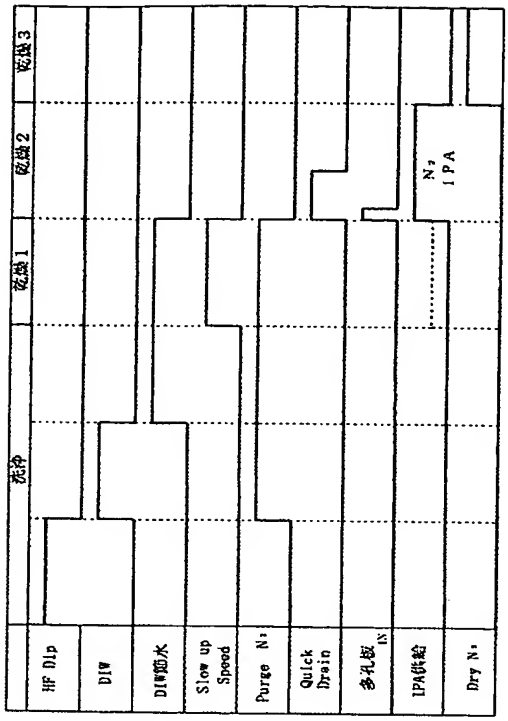
[Drawing 4]



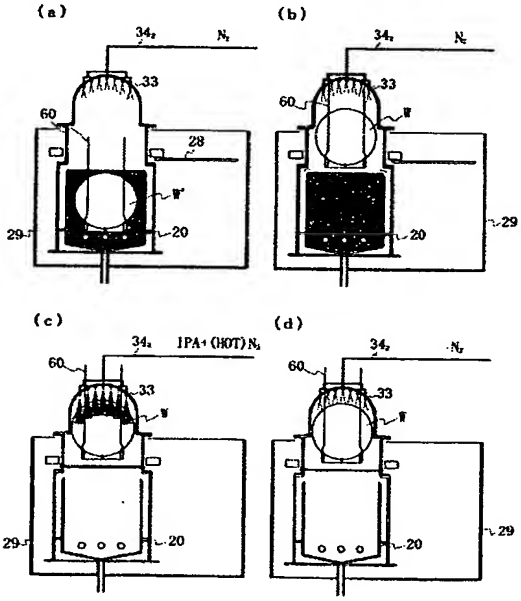
[Drawing 5]



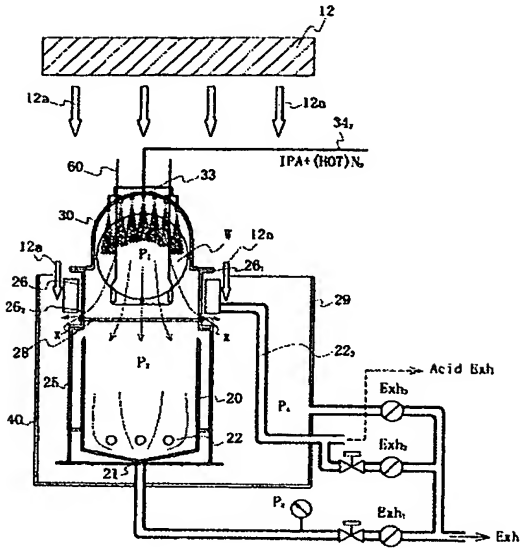
[Drawing 6]



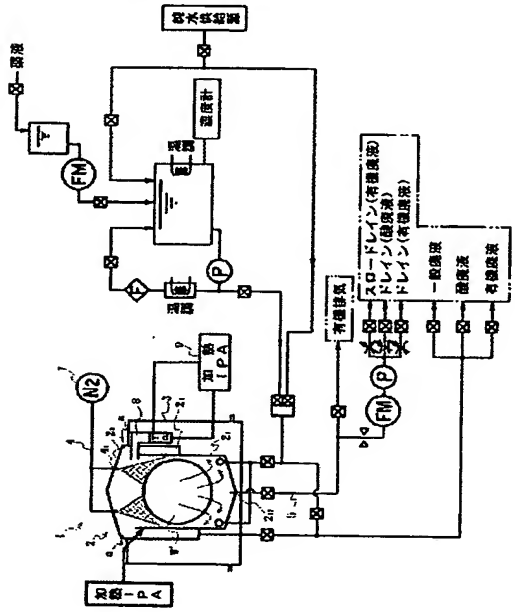
[Drawing 7]



[Drawing 8]



[Drawing 9]



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最終頁に続く

(54)【発明の名称】基板処理法及び基板処理装置

(57)【特許請求の範囲】

【請求項１】

処理槽を洗浄処理部と乾燥処理部とに区分し、該両処理部の接合部に隙間を形成し、該隙間をシンクに連通させ、基板乾燥時に、該基板を該洗浄処理部から該乾燥処理部へ移動させ、該隙間が形成された下方に多孔板を挿入し、該乾燥処理部の内圧がシンクの内圧より高く、かつ該洗浄処理部の内圧が乾燥処理部の内圧より低くなるようにして、乾燥ガスを該基板に噴射させることを特徴とする基板処理法。

【請求項２】

前記洗浄処理部は、その底部に処理液供給部および処理液排出部をそれぞれ独立して設け、基板洗浄時に、以下の（ａ）～（ｄ）工程を行うようになした請求項１記載の基板処理法。

（ａ）該処理液供給部から前記処理槽内に薬液を供給し、該処理槽内に薬液を貯溜する工程、

（ｂ）該処理槽内に前記基板を投入浸漬して、所定時間該基板の薬液処理を施す工程、

（ｃ）薬液処理の終了後に該処理液供給部から洗浄液を供給し、該薬液を該処理槽から該処理液排出部を通して排出する工程、

（ｄ）該薬液を排出した後に、該洗浄液の供給を停止する工程。

【請求項３】

前記処理液排出部には、該処理液排出部にドレイン機構を設け、基板乾燥時に、前記洗浄処理部と前記乾燥処理部との間に多孔板を挿入すると同時に、該ドレイン機構を作動させ

前記洗浄処理部内の処理液を短時間に排出させることを特徴とする請求項１又は２記載の基板処理法。

【請求項４】

前記多孔板は、所定径の小孔を複数個設けたパンチングプレートであることを特徴とする請求項１～３の何れか１項記載の基板処理法。

【請求項５】

処理すべき複数枚の基板を互いに等ピッチで平行かつ垂直な姿勢で支持する支持手段と、該支持手段によって支持された基板の集合体を収容する洗浄処理槽と、該洗浄処理槽の上部開口を覆い乾燥処理槽として機能する蓋体とを備え、該蓋体は、該基板の集合体を収容できる大きさを有し、天井面が閉鎖され下部が開口した容器からなり、該容器の天井面に複数個の噴射ノズルが面状にほぼ等間隔に整列されて各噴射ノズル穴が該基板集合体に向けて設けられ、該蓋体が該洗浄処理槽の上部開口を覆う際に、該洗浄処理槽と該蓋体との間にシンクに連通した隙間が形成され、且つ、該隙間の下方に多孔板が挿入し得るようになっていることを特徴とする基板処理装置。

【請求項６】

前記洗浄処理槽は、その底部にそれぞれ独立して設けられた処理液供給部および処理液排出部と、該処理液供給部に接続されて該処理槽に処理液を供給する処理液供給系配管と、該処理液供給系配管に薬液を供給する薬液供給源と、該処理液供給系配管を介して洗浄液を該処理槽に供給しかつこの洗浄液を該処理槽の上部から溢れさせることにより該基板を洗浄する洗浄液供給手段と、該処理液排出部に接続されて該処理槽から排出される洗浄液を該処理槽の外部に導く排出配管とを具備していることを特徴とする請求項５記載の基板処理装置。

【請求項７】

前記処理液排出部には、ドレイン機構を設け、前記基板集合体の乾燥時に前記多孔板が前記洗浄処理槽と前記蓋体との間に挿入されると同時に該ドレイン機構を作動させることを特徴とする請求項５又は６記載の基板処理装置。

【請求項８】

前記複数個の噴射ノズルは、前記基板集合体の外周縁に沿って、該外周縁と各ノズル穴との距離がほぼ等しくなるように前記容器の天井面に設けられていることを特徴とする請求項５～７の何れか１項記載の基板処理装置。

【請求項９】

前記多孔板は、所定径の穴を複数個有するパンチングプレートからなる請求項５～８の何れか１項記載の基板処理装置。

【発明の詳細な説明】

【０００１】

【発明が属する技術分野】

本発明は、半導体ウェーハ、液晶表示装置用基板、記録ディスク用基板、或いはマスク用基板や、その他の基板を処理するための基板処理法及びその装置に係り、詳しくは、前記各種基板の薬液による処理から乾燥等に至る一連の表面処理を１つの処理槽で行うことができるようにした基板処理法及び基板処理装置に関する。

【０００２】

【従来の技術】

半導体の製造工程において、各種基板のうち、例えば半導体ウェーハの表面を清浄なものにするために、ウェーハ表面を薬液によって洗浄したのち、純水等の処理液によって洗浄を行い、さらにイソプロピルアルコール（ＩＰＡ）等の有機溶剤を用いてウェーハを乾燥させる処理が行われている。より具体的には、この処理は、ウェーハを薬液及び純水によって洗浄したのち、ウェーハをＩＰＡのベーパに晒してウェーハの表面にＩＰＡを凝縮させ、このＩＰＡの凝縮により、それまでウェーハに付着していた純水をＩＰＡと置換させ、この純水がウェーハの表面から流れ落ちることに伴い、パーティクル等の汚染物質を洗い流す工程、その後、ＩＰＡを蒸発させてウェーハ表面を乾燥させる乾燥工程とからなる

。この乾燥工程において、ウェーハの表面に水滴が僅かでも残ると、ウェーハ表面にウォータマークが形成され、このウォータマークはパーティクルと同様にウェーハの品質を悪化させる原因となる。このため、半導体の製造工程においては、これらの汚染物質等がウェーハに付着しないようにしなければならない。そして、このような対策を講じたウェーハ等の基板表面処理法および処理装置が多数考案され実用化され、特許文献でも多く紹介されている。（例えば、特許文献１参照）

【０００３】

【特許文献１】

特開２００１－２７１１８８号公報（図１、第５頁右欄～第６頁左欄）

【０００４】

前記特許文献に記載された基板処理装置は、１つの処理槽を備え、この処理槽は、上部が開口した有底箱体と、その開口を覆う蓋体とからなり、箱体の開口は多数枚のウェーハを垂直状態で所要間隔をおいて並列的に支持収容し得る程度の大きさに形成され、箱体の深さはウェーハを没入状に浸漬した際にその上部側に不活性ガスを供給する適宜容積の上部空間が確保される程度の深さに形成されたものである。この処理槽を用いて、薬液処理、薬液を洗浄用純水によりウェーハの表面から洗い落とす水洗処理、この水洗処理が終了した後にウェーハの表面に付着残留している付着水を有機溶剤の蒸気と不活性ガスとの混合置換により除去する乾燥処理等に至る処理が行われる。

【０００５】

そこで、前記ウェーハの乾燥工程における処理槽内での不活性ガスの流れを調べたところ、図９に示したようなルートが観察された。なお、図９は処理槽内での不活性ガスの流れを模式的に示した断面図である。この基板処理装置１は、上面が開口した有底箱形の内槽2_1と、この内槽2_1の上部外周を包囲する外槽2_2と、この外槽の上部に設けられた開閉可能な蓋体2_3とからなる処理槽２を備えている。内槽2_1の底部には処理液排出穴$2_{1,2}$が形成され、この排出穴に排気管５が接続され、その他端は真空ポンプ等に連結されている。また、外槽2_2内にはペーパ吐出口８が突出し、これらの吐出口８はペーパ供給機構９に連結されている。さらに、蓋体2_3の上部には、ガス噴射ノズル4_1が取付けられ、その噴射ノズル4_1は配管４により窒素ガス供給源７に接続されている。

【０００６】

この基板処理装置１では、窒素ガス供給源７からの窒素ガスN_2（乾燥ガス）が処理槽２の上部から噴射されると、噴射された窒素ガスN_2は下方へ向って流れ、ウェーハ集積体Ｗ’へ噴射され、その後に、排気管５から槽外へ放出される。その際、一部の噴射ガスは外槽2_2と蓋体2_3との隙間ａからシンク３の外へ放出される。シンク３の外は大気圧になっている。またウェーハ集積体Ｗ’へ噴射されたガスは、図９の矢印で示すように内槽2_1の底壁面等に衝突して上昇し処理槽２内を還流し、この還流した後に排気管５から外へ放出される。そして、ウェーハ集積体Ｗ’は、噴射ノズル4_1から直接噴射されたガスおよび処理槽２内を還流したガスにより表面乾燥が行われるようになっている。

【０００７】

【発明が解決しようとする課題】

しかしながら、上記特許文献記載の基板処理装置では、乾燥ガスの一部は処理槽内で還流されながら排気管から外へ放出されるので、処理槽内での乾燥ガスの流れは、一定とならず乱流状態になってしまう。その結果、個々のウェーハへは均一に窒素ガスが供給されず、基板面に処理ムラが発生する。この処理ムラは、乾燥ガスが多くなればなる程、乱流状態がひどくなり処理ムラも拡大し、安定した表面処理が不可能になる。また、内槽の底部の処理液排出穴が１つのため、乾燥ガス流量が多く、例えば１００Ｌ／ｍｉｎ程度となると槽内の乱流が激しくなることも判明している。その乱流の発生源の１つは、処理槽が乾燥処理部と洗浄処理部とが区分されていないためとも考えられる。

【０００８】

一方、排気管が接続される排気処理設備を調べてみると、上記乱流の原因がこの排気処理設備にもあることが分かった。通常、基板処理装置からの排気管は、工場内の排気処理設

備に接続されている。この排気処理設備は、真空ポンプが使用され、このポンプに複数個の機器・装置が接続され一括して排気処理の管理がなされている。そのため、個々の機器・装置の仕様を考慮してそれらの機器・装置毎のきめ細かな調整が困難であり、個別調整を実施しようとすると設備費の高騰が避けられない。しかも、通常の排気処理設備では、起動初期あるいは停止時に排気元圧の変動が激しくなっている。このため、高品質を維持しながら大量のウェーハを処理するには、この排気処理設備における排気元圧の影響を最少にしなければならないが、上記の基板処理装置ではその調整が極めて難しい。

【０００９】

近年、処理槽内で処理されるウェーハ等の基板は、処理能率を高めるために、可能な限り多数の基板を昇降機構に保持した状態で槽内に挿入する必要があり、場合によっては５０～１００枚といったロット単位で基板が処理槽内で同時に処理される。この場合、各基板は垂直に立てた姿勢で互いに平行に支持されるため、基板間のピッチは数ｍｍと狭いものとなる。このように多量の基板を処理槽内で薬液処理したり、純水によるリンス処理を行う場合、処理槽内に多量の基板を挿入したまま、処理液を処理槽内部に供給したり、他の処理液等に置換させる必要があるが、その際に各基板に対する処理速度がばらついたり、乾燥に要する時間が長くかかることからパーティクル等が発生しやすい等の課題がある。

【００１０】

この発明は、以上のような事情を勘案し、特に従来例における乾燥工程での課題を解決するものであり、本発明の第１の目的は、乾燥ガスが複数枚の基板集合体に均一且つ安定に供給できるようにした基板処理法を提供することにある。

【００１１】

本発明の第２の目的は、大量の基板を処理する際に、基板の表面に付着する汚染物資を少なくし、汚染による歩留りの低下を防止した基板処理装置を提供することにある。

【００１２】

【課題を解決するための手段】

上記目的は、以下の手段によって達成できる。すなわち、本発明の基板処理法は、処理槽を洗浄処理部と乾燥処理部とに区分し、該両処理部の接合部に隙間を形成し、該隙間をシンクに連通させ、基板乾燥時に、基板を該洗浄処理部から該乾燥処理部へ移動させ、該隙間が形成された下方に多孔板を挿入し、該乾燥処理部の内圧がシンクの内圧より高く、かつ該洗浄処理部の内圧が乾燥処理部の内圧より低くなるようにして、乾燥ガスを該基板に噴射させることを特徴とする。

【００１３】

この基板処理法によると、基板乾燥時に乾燥ガスは、乾燥処理部において複数枚の基板の群に供給された後に、一部の乾燥ガスは上記隙間からシンクへ、残りが洗浄処理部を通って外部へ排気される。この際、乾燥処理部の内圧が洗浄処理部の内圧より確実に高くなるので、乾燥処理部での乾燥ガスのダウンフローがスムーズになり、乾燥ガスの層流によって複数枚の基板の群の表面処理を効率的に行うことができる。

【００１４】

また、本発明の基板処理法は、前記洗浄処理部は、その底部に処理液供給部および処理液排出部をそれぞれ独立して設け、基板洗浄時に以下の（ａ）～（ｄ）工程を行うようになしたことを特徴とする。

（ａ）該処理液供給部から前記処理槽内に薬液を供給し、該処理槽内に薬液を貯溜する工程、

（ｂ）該処理槽内に前記基板を投入浸漬して、所定時間該基板の薬液処理を施す工程、

（ｃ）薬液処理の終了後に該処理液供給部から洗浄液を供給し、該薬液を該処理槽から該処理液排出部を通して排出する工程、

（ｄ）該薬液を排出した後に、該洗浄液の供給を停止する工程。

【００１５】

この基板処理法によると、共通の処理槽を用いて薬液、洗浄および乾燥の一連の処理を行うことができるので、この一連の処理中に基板が空気に晒されることがない。したがって

、基板処理の効率が上がると共に、自然酸化膜の形成を抑制、およびパーティクル等による汚染を防止できる。

【００１６】

前記処理液排出部には、該処理液排出部にドレイン機構を設け、基板乾燥時に、前記洗浄処理部と前記乾燥処理部との間に多孔板を挿入すると同時に、該ドレイン機構を作動させ前記洗浄処理部内の処理液を短時間に排出させること、また、前記多孔板は、所定径の小孔を複数個設けたパンチングプレートであることが好ましい。

この基板処理法によると、パンチングプレートの各小孔は、乾燥ガスを分散させると共に、オリフィス効果によって、乾燥処理部の内圧を洗浄処理部の内圧より確実に高くできる。また、該ドレイン機構の作動により、前記洗浄処理部内の処理液を素早く大量に排出させることにより、乾燥処理部での乾燥ガスのダウンフローがスムーズになり、乾燥ガスの層流によって複数枚の基板群の表面処理を効率的に行うことができる。

【００１７】

本発明の基板処理装置は、処理すべき複数枚の基板を互いに等ピッチで平行かつ垂直な姿勢で支持する支持手段と、該支持手段によって支持された基板の集合体を収容する洗浄処理槽と、該洗浄処理槽の上部開口を覆い乾燥処理槽として機能する蓋体とを備え、該蓋体は、該基板の集合体を収容できる大きさを有し天井面が閉鎖され下部が開口した容器からなり、該容器の天井面に複数個の噴射ノズルが面状にほぼ等間隔に整列されて各噴射ノズル穴が該基板集合体に向けて設けられ、該蓋体が該洗浄処理槽の上部開口を覆う際に、該洗浄処理槽と該蓋体との間にシンクに連通した隙間が形成され、且つ、該隙間の下方に多孔板が挿入されるようになっていることを特徴とする。

【００１８】

この基板処理装置によると、基板乾燥時に乾燥ガスは、乾燥処理槽において複数枚の基板の群に供給された後に、一部の乾燥ガスは上記隙間からシンクへ、残りが洗浄処理槽を通って外部へ排気される。この際、乾燥処理槽の内圧が洗浄処理部の内圧より確実に高くなるので、乾燥処理槽での乾燥ガスのダウンフローがスムーズになり、乾燥ガスの層流によって複数枚の基板群の表面処理を効率的に行うことができる。

【００１９】

また、前記洗浄処理槽は、その底部にそれぞれ独立して設けられた処理液供給部および処理液排出部と、該処理液供給部に接続されて該処理槽に処理液を供給する処理液供給系配管と、該処理液供給系配管に薬液を供給する薬液供給源と、該処理液供給系配管を介して洗浄液を該処理槽に供給しかつこの洗浄液を該処理槽の上部から溢れさせることにより該基板を洗浄する洗浄液供給手段と、該処理液排出部に接続されて該処理槽から排出される洗浄液を該処理槽の外部に導く排出配管とを具備していることが好ましい。

この構成によると、共通の処理槽を用いて薬液、洗浄および乾燥の一連の処理を行うことができるので、この一連の処理中に基板が空気に晒されることがない。したがって、基板処理の効率が上がると共に、自然酸化膜の形成を抑制、およびパーティクル等による汚染を防止できる。

【００２０】

前記処理液排出部には、ドレイン機構を設け、前記基板集合体の乾燥時に前記多孔板が前記洗浄処理槽と前記蓋体との間に挿入されると同時に該ドレイン機構を作動させること、また、前記複数個の噴射ノズルは、前記基板集合体の外周縁に沿って、該外周縁と各ノズル穴との距離がほぼ等しくなるように前記容器の天井面に設けられていること、さらに、前記多孔板は、所定径の穴を複数個有するパンチングプレートであることが好ましい。

この基板処理装置によると、乾燥ガスを前記基板集合体へ均一に安定して供給できるようになる。

【００２１】

【発明の実施の形態】

以下、この発明の好適な実施の形態を図面を参照しながら説明する。なお、本発明は、図面に記載されたものに限定されるものではない。図１は、本発明の一実施形態の基板処理

装置を示す断面図、図２は処理槽の一方からの側面図、図３は他方からの側面図、図４は蓋体の平面図（この図は蓋体上部から透視した平面図である）、図５は図４に示す蓋体の側面図である。

【００２２】

図１を参照して、基板処理装置１０は、基板の一例として半導体ウェーハＷを処理するための設備である。ここで言う処理とは、例えばウェーハＷを薬液によってエッチングする、ウェーハＷの表面をフッ酸処理する工程、或いはウェーハＷを水洗いするリンス処理、水洗い後のウェーハＷを有機溶剤で乾燥する乾燥処理などである。これら一連の処理は１つの処理槽１５内で連続して行われる。

【００２３】

処理槽１５は、図２～５に示すように、その付属装置と一緒にして収容できる容積を有する収容室１１に設置される。付属装置は、収容室内の空調を行う空調装置、処理槽へ各種の処理液を供給する供給源、ウェーハ搬送機構等であり、図ではこれらは省略されている。処理槽１５は、上面が開口した有底箱形の内槽２０と、この内槽２０の上部外周を包囲する外槽２５と、この内槽２０の開口を覆う蓋体３０とを備え、内外槽２０、２５はシンク２９内に収容される。内外槽２０、２５は、フッ酸やＩＰＡ等の有機溶剤によって腐食されにくい材料、例えばポリフッ化ビニリデンなどで形成される。

【００２４】

内槽２０は、大量の大判ウェーハＷ、例えば直径３００ｍｍ、５０枚程度を保持具６２で保持して、処理液に浸漬して処理できる深さを有し、その底部に処理液排出部２１及び処理液供給部２２が設けられる。基板保持具６２は、例えばカセットガイドを用い、このカセットガイド６２には複数枚のウェーハＷが互いに平行に等ピッチで且つ垂直に起立した状態で保持される。この基板保持具（カセットガイド）６２は、昇降機構６０に連結され、この昇降機構には昇降手段６１が設けられ、この昇降手段６１によりカセットガイド６２が上下垂直方向へ移動され、内槽２０への出し入れが行われる。図２の「Ｄｒｙ　Ｐｏｓｉｔｉｏｎ」は、乾燥工程の位置を表わし、「Ｒｉｎｓｅ　Ｐｏｓｉｔｉｏｎ」は洗浄工程の位置を表わしている。昇降手段６１には、例えばエアシリンダー機構が使用される。

【００２５】

カセットガイド６２からのウェーハ集合体の取り出しは、移動機構５０により行われる。この移動機構５０は、ロボット機構（図示省略）に連結された複数本の把持爪50_1、50_2を備え、これらの把持爪50_1、50_2によって、ウェーハ集合体が把持され、所定の場所へ移動される。また、処理液排出部２１は、図２に示すように、小径の排出口21_1と大径の排出口21_2とからなり、大径の排出口21_2は、処理槽内の処理液を素早く排出するドレイン機構として機能する。小径の排出口21_1は、内槽２０の底部および管内に貯留された処理液を排出させるものである。外槽２５は、内槽２０の上部から溢れ出る処理液を受け入れるためのオーバーフロー槽として機能する。この外槽２５の低い位置に排出口25_1が設けられる。

【００２６】

蓋体３０は、図５に示すように、下部が開口し上部が閉鎖され内部に多数枚のウェーハＷを集めたウェーハ集合体Ｗ’を収納できる大きさを有する箱状容器３１からなり、この容器３１は、フッ酸やＩＰＡ等の有機溶剤によって腐食されにくい材料で形成される。この蓋体３０は、移動手段５５（図３参照）より水平方向へ移動できるようになっている。この移動手段５５は、図２の矢印で示すように、蓋体３０を内槽２０の上部に水平方向へ移動させることにより、内槽２０の開口を塞いだり、開いたりする。すなわち、内槽２０の上に位置する蓋体３０を垂直方向へ所定距離持ち上げ、水平方向へ移動し、そののち、垂直方向の下方へ降ろして、待機状態に保持される。この蓋体３０の移動は、内槽２０内へのウェーハ集合体Ｗ’の搬入及び処理済のウェーハ集合体を内槽２０から取り出す際に行われる。

【００２７】

また、箱状容器３１は、図５に示すように、その上部にほぼアーチ状の天井面３２が形成され、この天井面３２に不活性ガスを噴射する複数個の噴射ノズル33_1～33_7がほぼ等間隔に四方に整列して配設される。複数個のノズル３３は、図４に示すように、ウェーハ集合体Ｗ’の上方にあって、行方向にほぼ等間隔で配列された複数個の噴射ノズル33_1～33_7が列方向にもほぼ等間隔に複数列が配設される。図４では行方向に７個配列したものが６列、計４２個の噴射ノズル33_1～33_{42}がウェーハ集積体Ｗ’の上部外周縁に配設されている。行方向における７個の噴射ノズル33_1～33_7は、ウェーハ集合体Ｗ’との関係は、図５に示すように、各噴射ノズル33_1～33_7とウェーハ集合体Ｗ’の外周縁との距離はほぼ等しくなるように天井面３２に配設される。天井面３２をアーチ状に形成することにより、ウェーハＷは、概ね円板状をなしているので、上記の距離を等しくすることが容易になる。この天井面の形状は、ウェーハＷの形状に合わせて変更され、上記の距離をほぼ等しくすることが好ましい。

【００２８】

各噴射ノズル３３は、ガス供給管34_2が接続され、この供給管34_2は分岐され、これらの分岐管$34_{2\,1}$、$34_{2\,2}$にそれぞれ噴射ノズル３３の個数が同じか、或いはほぼ等しくなる数が結合される。これにより、各噴射ノズルにほぼ均等にガスを分配することができる。これらの各噴射ノズル３３は、それぞれ噴射ガスが所定角度で拡散されるものを使用し、各噴射ノズルからウェーハ集合体の外周縁へガスが噴射された際に、隣接する噴射ノズル、例えば噴射ノズル33_2と噴射ノズル33_3と間の噴射ガスがウェーハ集合体の外周縁ｂで重なるように設定することが好ましい。複数個の噴射ノズル３３を上記のようにして天井面３２に整列して配列することにより、ウェーハ集合体Ｗにほぼ均一にガスを供給できる。

【００２９】

内外槽２０、２５と蓋体３０との間には、図２、３、５に示すように、中間連結部材２６及び多孔板挿入機構２７が配設される。中間連結部材２６は、蓋体３０の下部開口と同じ大きさの開口を有す筒状体で形成される。この筒状体は、フッ酸やＩＰＡ等の有機溶剤によって腐食されにくい材料で形成される。この中間連結部材２６は、多孔板挿入機構２７の上方に設けられ、下方の開口26_2は多孔板を収納した枠体27_1の上面にほぼ当接されるように位置決めされ、上方の開口26_1は箱状容器３１の下部開口31_1と嵌合される。なお、蓋体３０を直接枠体27_1に嵌合させるようにして中間連結部材を省いてもよい。

【００３０】

多孔板２８は、所定の処理が終了したウェーハ集積体Ｗ’を乾燥する工程において、内外槽２０、２５と中間連結部材２６との間に挿入される平板状のプレートからなり、板状面には複数個の小孔が穿設されたものである。この多孔板は、フッ酸やＩＰＡ等の有機溶剤によって腐食されにくい材料で形成される。この多孔板２８は、枠体27_1内に収納され、移動機構（図示省略）に連結され、図２に示すように、水平方向にスライド移動される。多孔板２８を収納する枠体27_1は、所定の縦幅（垂直方向）を有しており、多孔板２８が枠体27_1に収納された際に、枠体27_1と多孔板２８との間に隙間27_2が形成されるようになっている。

【００３１】

この隙間27_2は、例えば２ｍｍ程度の隙間で、乾燥工程において、乾燥ガスの一部がシンク２９内へ放出されるようになっている。したがって、内槽２０と蓋体３０との間に隙間ｘ（図８ではこの隙間をｘで表わしている）が形成されるので、この隙間ｘにより内槽２０と蓋体３０との間が密閉されることなく半密閉、すなわち、乾燥処理部と洗浄処理部との間が半密閉状態となる。また、多孔板２８は、内外槽２０、２５と中間連結部材２６との間に挿入され、内槽と蓋体とを区分、すなわち洗浄処理部と乾燥処理部とを仕切るシャッタとして機能する。

【００３２】

次に、図１を参照して前記処理槽と付属装置との配管接続を説明する。内槽２０の底部に

設けられた処理液供給部２２には、処理液導入管２２$_1$が接続され、この導入管２２$_1$は流量制御弁及びポンプを介して純水供給源３８に接続されている。この処理液導入管２２$_1$は、処理液供給系配管の機能をなし、この配管と流量制御弁及びポンプとで洗浄液供給手段が構成される。また、この処理液導入管２２$_1$には、同様に流量制御弁を介して薬液供給源３９にも接続されている。薬液供給源３９は、所望の薬液を所定濃度及び所定温度に調製するための薬液調合手段（図示省略）を備えている。薬液は、処理の目的（例えば洗浄、エッチング、酸化等の処理）に応じて、例えばフッ酸、塩酸、過酸化水素水、硫酸、オゾン水、アンモニア水、界面活性剤、アミン系有機溶剤、フッ素系有機溶剤、電解イオン水などから選択され、必要に応じてこれら複数の薬液を混合したものが使用される。

【００３３】

また、内槽２０の底部に設けられた処理液排出部２１は、図２に示すように、小径の排出口２１$_1$と大径の排出口２１$_2$とからなり、それぞれに内槽排液管２３$_1$、２３$_2$に接続され、これらの排液管２３$_1$は開閉弁、ポンプ、流量制御弁を介して排液処理設備４０に接続されている。さらに、排液管２３$_2$も同様に開閉弁、ポンプ、流量制御弁を介して排気処理設備４１に接続される。また、シンク２９も排気処理設備４１$_1$に接続されている。外槽２５の低い位置には、ドレイン管２５$_1$が接続され、このドレイン管２５$_1$は排液管２３$_1$に接続されている。

【００３４】

処理槽１５の近傍には、ベーパ供給機構３７が設けられる。このベーパ供給機構３７は、ウェーハＷの表面に付着残留している付着水と混合し易く、表面張力が極めて小さい、例えばイソプロピルアルコール（ＩＰＡ）溶剤等からなる有機溶剤を貯溜すると共に、この有機溶剤を加熱せしめて気化せしめるベーパ発生槽３７$_1$を備えている。このベーパ発生槽３７$_1$は、加熱槽３７$_2$内の温水に浸漬され、有機溶剤を加熱せしめて気化せしめる。このベーパ発生槽３７$_1$と有機溶剤（ＩＰＡ）供給源３６とは、配管３６$_1$で接続され、ベーパ発生槽３７$_1$へＩＰＡが供給される。

【００３５】

また、ベーパ発生槽３７$_1$と第２の窒素ガスN_2発生源３５とは、分岐管３５$_{1,1}$、３５$_{1,2}$で接続されている。一方の分岐管３５$_{1,2}$からは、ベーパ発生槽３７$_1$の底部へ窒素ガスN_2が送られ、ベーパ発生槽３７$_1$内に貯留されているＩＰＡ内に気泡を発生させ、ＩＰＡの蒸発を促進する。また、他方の分岐管３５$_{1,1}$から供給される窒素ガスN_2は、キャリアガスとして利用される。また、このベーパ発生槽３７$_1$は、配管３７$_{1,2}$を通って配管３４$_2$に連結され、ベーパ発生槽３７$_1$から噴射ノズル３３へキャリアガスN_2およびＩＰＡ蒸気の混合ガスが供給される。第１の窒素ガスN_2発生源３４は、配管３４$_1$、３４$_2$を通して噴射ノズル３３へ窒素ガスN_2が供給される。この窒素ガスN_2は、処理槽１５内をパージするだけでなく仕上げ乾燥にも使用される。

【００３６】

次に、この基板処理装置を用いた一連の処理を図６、図７を参照して説明する。なお、図６は一連の処理のタイムチャートを示し、図７は洗浄・乾燥工程を示し、同図（ａ）は洗浄工程、同図（ｂ）は乾燥工程１、同図（ｃ）は乾燥工程２、同図（ｄ）は乾燥工程３を説明する断面図である。

【００３７】

図１、６を参照して、先ず、処理槽１５の蓋体３０を開き、ウェーハ集合体Ｗ’を内槽２０内に収容する。このとき内槽２０内には、所望の薬液、例えばフッ酸（ＨＦ）が薬液供給源３９から処理液導入管２２$_1$と処理液供給部２２を通って内槽２０に供給され貯留されている。したがって、ウェーハ集合体Ｗ’は、この処理液に浸漬されることにより、薬液に応じた処理（例えばエッチングやフッ酸処理、洗浄等）が行われる。

【００３８】

この薬液処理が終了後、図７（ａ）に示すように、純水供給源３８から処理液導入管２２$_1$と処理液供給部２２を通して純水ＤＩＷが内槽２０へ供給される。この純水供給は、内槽２０の上部から溢れさせながら行われる。内槽２０から溢れた純水ＤＩＷは、外槽２５

へ流れ込み、ドレイン管２５，から排水管を通って排出される。この純水の供給を比較的長い時間かけて行い、内槽２０内に残留していた前記薬液ＨＦを押し出す。

【００３９】

この洗浄工程が終了したのち、図７（ｂ）に示す乾燥工程１では、純水ＤＩＷの連続供給を停止し、少量の純水を供給（ＤＩＷの節水）しながら、ウェーハ集合体Ｗ’を内槽２０からゆっくり（Ｓｌｏｗ　ｕｐ　Ｓｐｅｅｄ）引上げる。このウェーハ集合体Ｗ’の引上げと同時に、ＩＰＡを処理槽１５内へ供給するが少量のＩＰＡを供給することもできる。

【００４０】

次いで、図７（ｃ）に示す乾燥工程２では、処理槽１５底部の排出口２１，のドレイン機構弁を作動させて処理液を素早く排出し、多孔板２８を枠体２７，内に水平移動させて内外槽２０、２５と中間連結部材２６との間に挿入する。更に、内槽２０内に温められた窒素ガスN_2とＩＰＡガスとの混合ガスを供給する。これら動作は、チャートに示すように同時に行われる。この窒素ガスN_2は、ベーパ発生槽３７，内で加熱されている。この工程において、処理槽１５内の有機溶剤のベーパは、各ウェーハＷの表面に触れて、ウェーハＷの表面に有機溶剤のベーパが凝縮して有機溶剤の膜が形成される。ウェーハＷの表面に有機溶剤の膜が形成されると、それまでウェーハＷに付着していた純水が有機溶剤と置換されるので、ウェーハＷの表面から流れ落ちる。図７（ｄ）の乾燥工程３では、置換されたＩＰＡを乾燥させるために窒素ガスN_2が供給されて、乾燥工程３が終了したら処理槽１５からウェーハ集合体Ｗ’が取り出される。

【００４１】

前記の乾燥工程１～３のうち、乾燥工程２における乾燥ガスの流れを調べてみると、図８に示したようなルートが観察された。図８は図７（ｃ）における乾燥ガスの流れを模式的に示した断面図である。乾燥ガス（ＩＰＡ＋ＨｏｔN_2）は、蓋体３０の上部の噴射ノズル３３からウェーハ集合体Ｗ’へ噴射される。このとき、内槽２０と蓋体３０との間に隙間ｘが形成されており、この隙間ｘにより内槽２０と蓋体３０との間が完全に密閉されることなく半密閉状態、すなわち、乾燥処理部と洗浄処理部との間が半密閉状態となっている。このため、ウェーハ集合体Ｗ’へ噴射された乾燥ガスは、その一部が内槽２０と蓋体３０との間の隙間ｘからシンク２９内へ流れる。

【００４２】

また、処理槽１５は空調された収容室１１内に設置されているので、この収容室１１の上方の空調機１２からエア１２ａが矢印の下方へ吹き付けられている。その結果、この隙間ｘから放出される乾燥ガスは、一部は配管２２，を通って排気され、残りのガスはエア１２ａと一緒にシンク２９内へ流れ、シンク２９に連結された排気装置により排気される。噴射ノズル３３から噴射された乾燥ガスは、隙間ｘを通って放出されるので、内槽２０へ流入するガス量はその分だけ少なくなる。この隙間ｘを通って放出される量は、比較的多量になっている。このため、排気処理設備における排気元の変動の影響を受けることなく乾燥ガスを排気することができる。

【００４３】

すなわち、乾燥ガスは、ウェーハ集合体Ｗ’へ噴射された後に、一部が隙間ｘからシンク２９内へ放出されるので、内槽２０へ流入するガス量はその分少なくなっている。このため、排気元の変動があってもその影響をあまり受けることなく乾燥ガスをスムーズに排気させることができる。さらに詳述すると、隙間ｘを設けることにより、排気元の変動を内槽および外槽に加えてシンクを含めた広い空間で受け止めるようになるので、内槽および外槽の狭い空間で受け止めるよりその影響が小さくでき、しかも収容室１１の上方より大量のクリーンエアーが供給されているので、さらにその変動の影響が小さくできる。

【００４４】

一方、多孔板２８は、板状体に複数個の小孔が存在したものであることから、ここを通過する乾燥ガスは、複数個の小孔によって分散され、かつオリフェス効果によって、蓋体３０と内槽２０との間、すなわち乾燥室を構成している蓋体と洗浄室を構成している内槽との間に大きな圧力差が発生し、乾燥室での乾燥ガスがスムーズにダウンフローしながら排

気される。このため、蓋体３０（乾燥処理部）の圧力が内槽２０（洗浄処理部）の圧力より確実に高くなる。

【００４５】

この状況を処理槽１５及びシンク２９内での各圧力関係を示すと、

$P_1 > P_2 > P_3 >$ 排気元圧

$P_1 > P_4 >$ 排気元圧

の関係が成立している。

ここでP_1は蓋体３０（乾燥処理部）の圧力、P_2は内槽２０、圧力P_3は排気管内での圧力、P_4はシンク２９内の圧力である。

【００４６】

したがって、処理槽１５及びシンク２９内での各圧力が上記の関係を満たすことにより、この乾燥ガスが処理槽１５内において層流を形成し、スムーズに排気管から槽外へ排気され、この過程において、乾燥ガスは、個々のウェーハに均一に供給され、基板の表面にウォータマークが形成されることがなく、また、パーティクルの除去および付着をも防止できる。しかも、パーティクルの再付着も阻止できる。その理由は、乾燥ガスが処理槽内で還流することがないからである。

【００４７】

【発明の効果】

以上詳述したように、本発明の基板処理法によれば、基板集合体に均一に乾燥ガスを供給できるので、基板の表面にウォータマークが形成されることがなく、しかもパーティクルの除去、付着あるいは再付着をも防止できる。

【００４８】

また、本発明の基板処理装置によれば、一連の処理工程を１つの密閉された処理槽内で行なわれるので、被処理基板が大気に全く触れることがなく、しかも、基板集合体に均一に乾燥ガスを供給できるので、基板の表面にウォータマークが形成されることがなく、しかもパーティクルの除去、付着あるいは再付着をも防止できる。

【図面の簡単な説明】

【図１】本発明の一実施形態の基板処理装置を示す断面図、

【図２】処理槽を示す側面図、

【図３】

図２の処理槽を他方からみた側面図、

【図４】

蓋体の平面図（この図は蓋体上部から透視した平面図である）、

【図５】

図４に示す蓋体の側面図、

【図６】

一連の処理のタイムチャートを示す表、

【図７】

洗浄・乾燥工程を示し、図７（ａ）は洗浄工程、図７（ｂ）は乾燥工程１、図７（ｃ）は乾燥工程２、図７（ｄ）は乾燥工程３を説明する断面図、

【図８】

図７（ｃ）における乾燥ガスの流れを模式的に示した断面図、

【図９】

従来技術の基板処理装置における処理槽内での不活性ガスの流れを示した断面図である。

【符号の説明】

１、１０　基板処理装置

１１　収容室

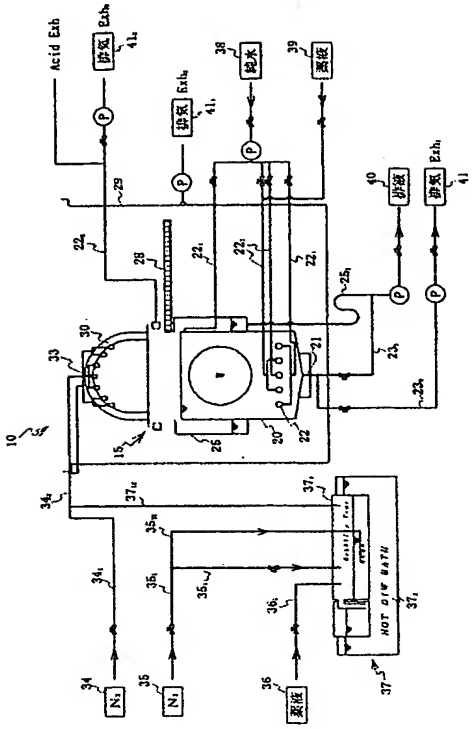
１２　空調機

１５　処理槽

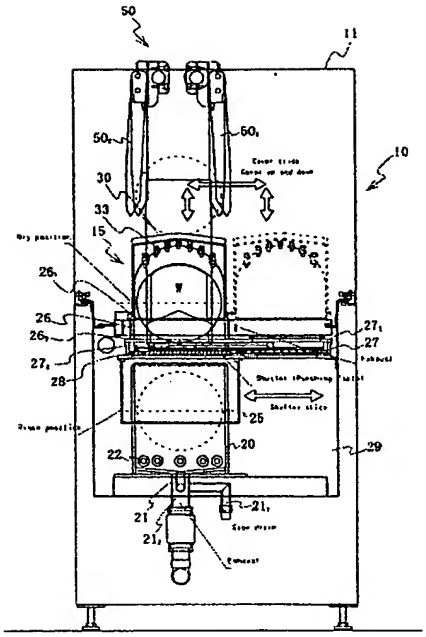
２０　内槽
２１　処理液排出部
２１₂　ドレイン機構
２２₁　処理液導入管（処理液供給系配管）
２２　処理液供給部
２５　外槽
２６　中間連結部材
２７　多孔板挿入機構
２８　多孔板
２９　シンク
３０　蓋体
３１　箱状容器
３３　噴射ノズル
３７　ベーパ供給機構
３７₁　ベーパ発生槽
５５　移動手段

【要約】
【課題】
乾燥ガスが複数枚の基板集合体に均一且つ安定に供給できるようにした基板処理法および装置を提供することにある。
【解決手段】
処理槽１０を洗浄処理部１５と乾燥処理部３０とに区分し、両処理部の接合部に隙間を形成し、この隙間をシンク２９に連通させ、基板乾燥時に、基板を洗浄処理部から該乾燥処理部へ移動させ、隙間が形成された下方に多孔板２８を挿入し、乾燥処理部３０の内圧がシンク２９の内圧より高く、かつ洗浄処理部１５の内圧が乾燥処理部３０の内圧より低くなるようにして、乾燥ガスを該基板に噴射するようにする。
この場合、前記多孔板２８は、所定径の小孔を複数個設けたパンチングプレートであることが好ましい。
【選択図】　図１

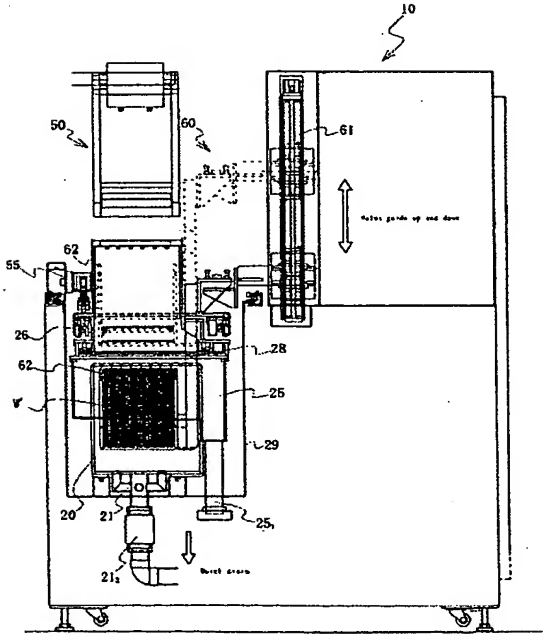
【図１】



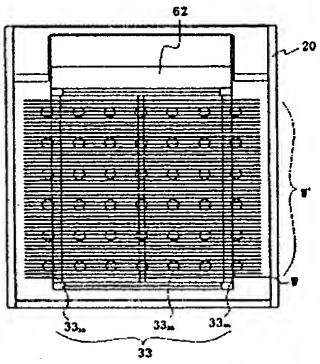
【図２】



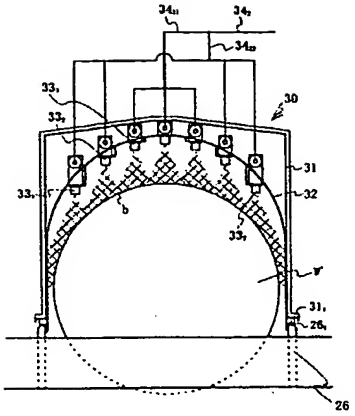
【図３】



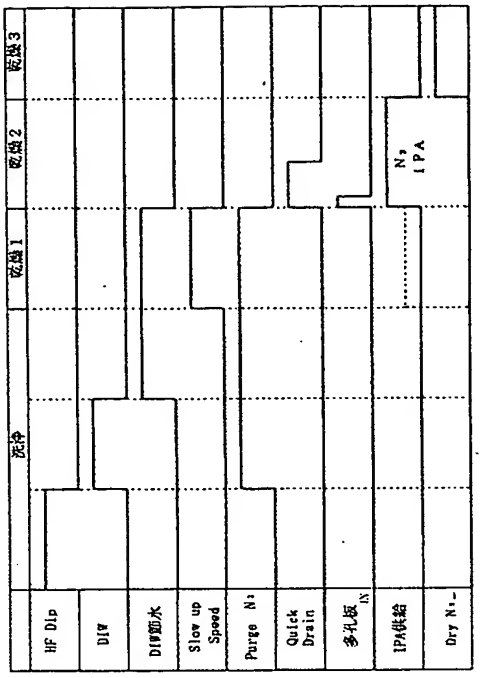
【図４】



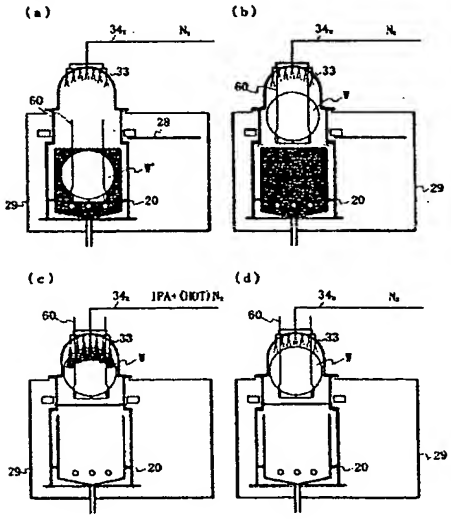
【図５】



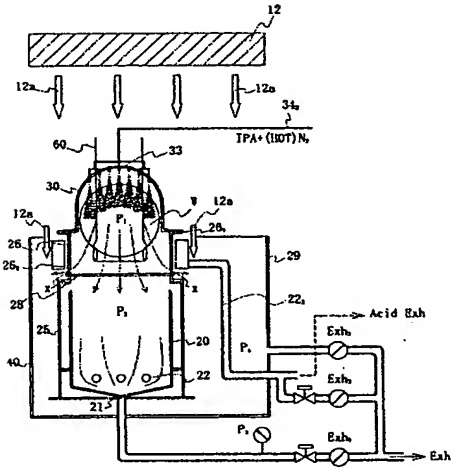
【図６】


乾燥3
乾燥2
乾燥1
洗浄
HF Dip
DIW
DIW節水
Slow up Speed
Purge N2
Quick Drain
多孔板
IPA供給
Dry N2

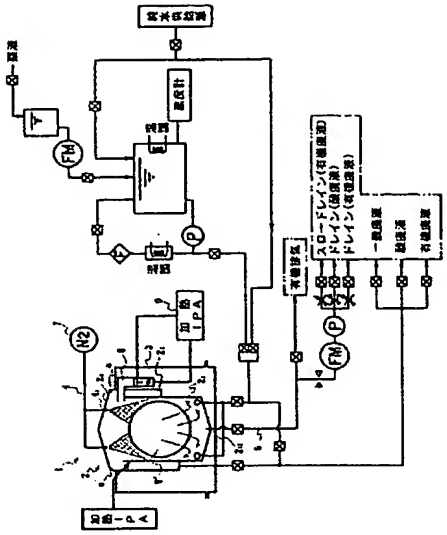
【図７】



【図８】


Acid Exh
Exh
Exh
Exh

【図９】



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